

CLAIMS

1. A multi-component fiber of thermoplastic polymers, comprising:
 - a. a first component of thermoplastic polymer having between 20-80% of the fiber by weight; and
 - b. a second component having between 80-20% of the fiber by weight and including (i) a thermoplastic polymer and (ii) an anti-microbial/anti-fungal inorganic additive, said first and second components are in a core-sheath configuration and the additive in said second component is from 0.1% to 20% by weight of fiber.
2. A fiber as defined in claim 1 wherein the additive is one selected from the group consisting of copper, zinc, tin and silver.
3. A fiber as defined in claim 2 wherein the additive is zeolite of silver.
4. A fiber as defined in claim 3 wherein said sheath is more than 30% of the cross section of the total fiber.
5. A fiber as defined in claim 4 wherein said additive particles are approximately 1 micron cubes and the sheath is approximately 2 microns thick.
6. A fiber as defined in claim 3 wherein the additives are 0.2 to 6.0% by weight of the multi-part fiber.
7. A multi-part fiber as defined in claim 4 wherein the zeolite of silver is dispersed in a carrier of PE, PET, or PBT.
8. A multi-part fiber as defined in claim 3 wherein the first and second components are blended with a fiber which is selected from the group consisting of cotton, wool, polyester, acrylic and nylon and which is free of anti-microbial agents.
9. A fiber as defined in claim 6, wherein the polymers are of at least one chosen from the group consisting of PE, PP, PET (polyester), PCT, PETG, Co-PET, Styrene, Halar®, PTT, 3GT, and polyamide 6 or 6,6.
10. A fiber as defined in claim 1 wherein there is a second additive which is at least one chosen from the group consisting of pigments, anti-odor compounds, hydrophilic, and hydrophobic materials.

11. A fiber as defined in claim 7 wherein the fiber size ranges from 0.7 dTex to 25.0 dTex.
12. A fiber as defined in claim 9 wherein said fiber is cut staple in lengths from 1.0 mm to 180.0 mm.
13. A fiber as defined in claim 9 wherein the fiber is continuous filament.
14. A bi-component fiber, comprising:
 - a. a first component of a high tenacity polymer having between 20-80% of the fiber by weight and constituting a core;
 - b. a second component of a hydrolysis resistant polymer having between 80-20% of the fiber by weight and constituting a sheath surrounding the core, and including an additive; and
 - c. the additive in said second component ranging from 0.1% to 20% by weight of the fiber and being selected from the group consisting of pigments, compounds creating a hydrophilic surface, and anti-microbial, anti-fungal and anti-odor materials.
15. The fiber as defined in claim 14, wherein said first component of high tenacity polymer is PET providing strength to the fiber, and said second component of hydrolysis resistant polymer is PCT providing a hydrolysis resistant surface with good wrinkle resistance, and resistance to long term washings in boiling water and strong soaps.
16. The fiber as defined in claim 15, wherein the core is constructed to have a high modulus with properties of tenacity and elongation similar to cotton.
17. The fiber as defined in claim 15 wherein the core is constructed to have a low modulus with properties similar to wool.
18. The fiber as defined in claim 15, wherein the core is constructed to have an intermediate modulus fiber with properties between cotton and wool.

19. The fiber as defined in claim 14 wherein the additive is hydrophilic to create a fiber that, in a garment, appears to wick body moisture away from the skin and evaporate to create comfort to a wearer.
20. The fiber as defined in claim 14 wherein the additive is pigment to provide uniform colors that do not fade significantly over long-term use and washing.
21. The fiber as defined in claim 14 wherein the fiber size ranges from 0.7 dTex to 25.0 dTex.
22. The fiber as defined in claim 14 wherein said fiber is cut staple in lengths from 1.0 mm to 180.0 mm.
23. The fiber as defined in claim 14 wherein the fiber is continuous filament.
24. The fiber as defined in claim 14 wherein the additive is zeolite of silver.
25. The fiber as defined in claim 14 wherein said sheath is more than 30% of the cross section of the total fiber.
26. A fiber as defined in claim 14 wherein said additive particles are approximately 1 micron cubes and the sheath is approximately 2 microns thick.
27. An anti-microbial fiber, comprising:
- a. a binder fiber made from low temperature polymer with a melting or softening temperature below 200 degrees C.;
 - b. an anti-microbial additive of an inorganic compound made from a metal chosen from the group consisting of copper, zinc, tin and silver added to the homopolymer fiber, the additive ranging from 0.1 to 20% by weight of the fiber; and
 - c. fibers which are free of anti-microbial additive being blended with said binder fiber, said blend of fibers having been heated to its melting temperature, thereby providing a fiber blend which can be used to produce an anti-microbial finished fabric able to withstand significant wear and washings and maintain its effectiveness.

28. The fiber as defined in claim 27, wherein said low temperature homopolymer is selected from the group consisting of PETG, PE, PP, Co-PET and amorphous PET.
29. The fiber as defined in claim 28, wherein said inorganic compound of said anti-microbial additive is zeolitic of silver which is dispersed in PE, PET or PBT before being added.
30. The fiber as defined in claim 29, wherein said additive is added directly to said low temperature homopolymer with predispersion.
31. The fiber as defined in claim 27, wherein the non-anti-microbial fiber is selected from the group consisting of cotton, wool, polyester, acrylic and nylon.
32. The fiber as defined in claim 27 wherein said low temperature homopolymer is PETG, said anti-microbial additive being zeolite of silver, and said non-anti-microbial fiber being cotton.
33. The fiber as defined in claim 32 wherein said PETG polymer with said zeolite of silver additive is blended with said cotton up to 10% by weight to produce a fiber particularly suitable for a bed sheet.
34. The fiber as defined in claim 23, wherein said binder fiber is activated in a drying cycle of a final bleaching operation, whereby said PETG melts and wets the surface of said cotton fibers to carry the anti-microbial characteristics to the entire bed sheet with an added benefit of increasing strength and reducing pilling.
35. The fiber as defined in claim 27, wherein the fiber size ranges from 0.7 dTex to 25.0 dTex, and the fiber is cut staple in lengths from 1.0 mm to 180.0 mm.
36. The fiber as defined in claim 27, wherein the fiber is a continuous filament in a wrap spun application and said non-anti-microbial fiber is spun around an anti-microbial filament.
37. The product of claims 1 or 14 or 27 forming at least a part of a multi-layer incontinent article.
38. The product of claim 37, wherein said article is a garment.
39. The product of claim 37, wherein said article is a linen.
40. The product of claim 37 wherein said article is a bed pack.
41. The product of claim 37 wherein said article is prepared of woven fabric, non-woven fabric, or knitted fabric.
42. The product of claim 37 wherein said article is a diaper.

- 43. The product of claim 37 wherein said article includes an absorbent pad.
- 44. The product of claim 37 including a wick layer and an absorbent layer.
- 45. The product of claim 44 wherein the layer which is intended to be against a wearer's skin is made of anti-microbial fibers.
- 46. The product of claim 37 wherein said article is underwear.
- 47. The product of claim 37 wherein said article is pajamas.
- 48. The product of claims 1 or 14 or 27 forming at least part of a multi-layer air filter.
- 49. The product of claim 48 wherein an anti-odor agent is added to the fiber.
- 50. The product of claim 48 wherein at least one layer has the anti-microbial fiber, said layer being on the intended upstream side of the other layers.
- 51. The product of claims 1 or 14 or 27 forming at least part of a multi-layer wound care or burn dressing.
- 52. The product of claim 51 wherein at least one layer has the anti-microbial fiber, said layer being on the intended skin side of the other layers.
- 53. The product of claim 52 wherein at least one other layer is of an absorbent material.
- 54. The product of claim 27 forming at least part of a fabric wherein PETG is used as the carrier for color pigments for said fabric.
- 55. The product of claim 54 wherein the PETG has been melted as a low temperature and has had an anti-microbial and/or a colorant added thereto prior to melting.
- 56. The product of claims 1 or 14 or 27 forming at least part of a multi-layer footwear component.
- 57. The product of claim 56 wherein said component is an insole, midsole, box toe, counter, lining.
- 58. The product of claim 57 wherein the anti-microbial fiber is used in the layer which is nearest the foot of a wearer.
- 59. The product of claim 58 wherein there is a support layer of latex attached to the layer containing the anti-microbial fiber.
- 60. The product of any of claims 1 or 14 or 27 forming at least part of a multi-layer laminate of high porosity between two internal layers thereof, one of which is bonded to the other with lateral fibers traversing parts of both layers, one or

both of such layers incorporating anti-microbial agents, and means for acquiring moisture vapor into the laminate and trapping it there, one of the internal layers having higher strength properties than the other and the other having a higher moisture retention capacity.

61. The product of claim 60 as an insertable/removable insole for a shoe or the like.

62. The product of any of claims 1 or 14 or 27 forming at least part of a multi-layer partition or as a fabric for office, hospital, waiting area, classrooms, busses, cars, and the like and also curtains, upholstery, carpets and bedspreads.

63. The product of any of claims 1 or 14 or 27 forming at least part of a car wash material.

64. The product of any of claims 1 or 14 or 27 forming at least part of a filter or a batt in a car wash water recycle storage tank.

65. The product of any of claims 1 or 14 or 27 forming at least in part institutional and home furnishings, including bed sheets, pillow cases, mattress pads, blankets, towels, drapes, bedspreads, pillow shams, carpets, walk-off mats, napkins, linens, wall coverings, upholstered furniture, liners, mattress ticking, mattress filling, pillow filling, carpet pads, and upholstery fabric.

66. The product of any of claims 1 or 14 or 27 forming at least in part athletic clothing, athletic wear liners and component fabrics.

67. The product of any of claims 1 or 14 or 27 forming at least in part a mop head fabric.

68. The product of any of claims 1 or 14 or 27 forming at least in part a medical wipe.

69. The product of any of claims 1 or 14 or 27 forming at least in part a dust mask.

70. The product of any of claims 1 or 14 or 27 forming at least in part a humidifier evaporation surface media and/or a circulation/aeration system pad.

71. The product of any of claims 1 or 14 or 27 forming at least in part a boat bilge anti-microbial pad.

72. The product of any of claims 1 or 14 or 27 forming at least in part a laundry bag.

73. The product of any of claims 1 or 14 or 27 forming at least in part a piece of apparel.
74. The product of any of claims 1 or 14 or 27 forming at least in part a nautical fabric.
75. The product of any of claims 1 or 14 or 27 forming at least in part a layer of a wide stiff plastic sheet
76. A laminate comprising:
 a tough extruded core of thermoplastic resin such as ionomer, EVA or styrene stiffened ionomer and at least one impact resistant strength layer of nonwoven material.
 the needle punched nonwoven being made from a bi-component staple fiber or blend of PET staple fiber and binder staple fiber or blend of PET staple fiber and bi-component staple fiber, and having a combination of PET fibers and PETG or other copolymer or homopolymer fibers as binding agent for PET.
77. A laminate as defined in claim 76 wherein the thermoplastic components being miscible or mechanically compatible to allow for homogenization and incorporation into the extruded thermoplastic core thereby providing for complete recyclability of scrap material.
78. A stiff, moldable laminate, comprising:
 a layer of tough thermoplastic resin;
 a nonwoven fabric layer;
 a tough extruded core of thermoplastic resin;
 at least one impact resistant strength layer of nonwoven material constructed from a BiComponent staple fiber or blend of PET staple fiber and binder staple fiber or blend of PET staple fiber and BiComponent staple fiber, the nonwoven layer using a combination of PET fibers and PETG or other copolymer or monopolymers fibers which act as a binding agent for PET.
79. A laminate as defined in claim 78, wherein the staple fiber is 4-15 denier and 38 to 76mm in length.
80. A laminate as defined in claim 79, wherein the thermoplastic components are miscible or mechanically compatible to permit homogenization and incorporation into the extruded thermoplastic core.
81. A laminate of a binding agent which is a thermoplastic binder fiber or a bi-

component binder fiber which is thermally activated to bind and stiffen a nonwoven fabric into which it is incorporated.